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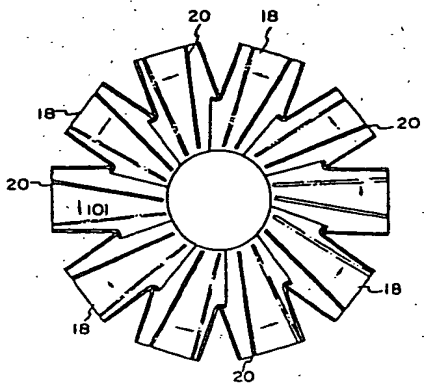
(54) Controlling the flow of articles in combinatorial weighing apparatus.

(57) A combinatorial weighing apparatus comprises a plurality of weighing machines, a dispersing table, and a plurality of supply troughs (18) extending from the dispersing table to the respective weighing machines for conveying thereto quantities of articles to be weighed, which articles are delivered to the supply troughs (18) by way of the dispersing table when the apparatus is in use. Flow-regulating plates (20) extend respectively within the said supply troughs and are selectively movable therein, thereby to improve the flow of such articles along the troughs (18) when the apparatus is in use.

Fig. 5



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CONTROLLING THE FLOW OF ARTICLES IN COMBINATORIAL WEIGHING APPARATUS

This invention relates to apparatus for controlling the flow of articles in a combinatorial weighing apparatus, for example of the kind that relies upon a computer which performs combinatorial arithmetic operations based on weight values of articles measured by a plurality of weighing machines associated with a plurality of article-receiving weighing hoppers to select a combination of the weighing hoppers that gives a total weight equal or closest to a preset weight and in which the articles are released from the thus selected weighing hoppers.

Supply feeders heretofore employed in computerized weighing apparatus, scales, are manufactured to a fixed size and are not adjustable in width during operation to permit regulation of the amount of article flow. The flow quantity can be controlled only by manually or automatically changing the amplitudes and/or operating time periods of the associated vibratory feeders or the level of supplied articles sensed by level sensors. However, the quantity of the articles supplied to the

computer scale cannot be finely adjusted as desired in spite of the complicated adjustment usually required for adjustment. It is desirable

to provide an apparatus for controlling the flow quantities of articles in computer scales in which such quantities can be regulated at the supply feeders for realizing fine adjustment of the supply quantities.

An embodiment of the present invention can be made to provide apparatus for controlling the flow quantities of articles in computer scales in which flow regulating plates, or baffle plates, are provided in the supply feeders for regulating flow quantities of the supplied articles and in which fine adjustment of the supply quantities can be effected through operation of the regulating plates.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Fig. 1 is a schematic side view of a computer scale;

Figs. 2 and 3 are plan and perspective views of a conventional supply feeder, respectively;

Fig. 4 is a plan view showing another conventional supply feeder;

Figs. 5 and 6 are plan and perspective views of

a supply feeder embodying the present invention, respectively;

Figs. 7 and 8 are plan and sectional views showing an operating mechanism of a regulating plate for use in the supply feeder of Figures 5 and 6; and

Fig. 9 is a diagrammatic view showing another operating mechanism for a regulating plate for use in the supply feeder of Figures 5 and 6.

Referring to Fig 1, illustrating a computerized weighing apparatus , a dispersing table 1 in the form of an inverted cone is supported on an electromagnetic vibrator 2. A plurality of supply feeders 3 are arranged radially about the dispersing table 1 and have their inner ends positioned below and in close proximity to the outer periphery of the dispersing table 1. Each supply feeder 3 is supported on an electromagnetic feeder 7. The vibrators 7 and the vibrator 2 associated with the dispersing table are placed on a support

table 10 secured to a plurality of supporting legs 12 affixed in turn to a machine frame 13. A supporting pillar 9 mounting a light-projector 8 and another supporting pillar 9' mounting a light receiver 8' are secured on the supporting table 10 symmetrically with respect to the dispersing table 1. The apparatus also has a plurality of weighing machines 4 each of which has a pool hopper 5 adapted for receiving articles to be weighed from an associated one of the supply feeders 3, a weighing hopper 15 adapted for receiving the articles from the pool hopper 5, a weighing unit 11 adapted for weighing the articles received in the weighing hopper 15, and a driving unit 6 having a pair of levers 17, 16 associated with the weighing hopper 15 and the pool hopper 5 for closing and opening these hoppers. Each supply feeder 3 has its foremost part protruding into the pool hopper 5 associated therewith so that the articles delivered thereto from the supply feeder 3 may flow into the pool hopper 5. A funnel-shaped collecting chute 14 is mounted on the frame 13 and has its flared upper opening end sized to receive the articles from the weighing hoppers 15 of the weighing machines 4. The articles thus collected are delivered to a subsequent process through the lower opening end of the collecting chute.

Figs. 2 through 4 illustrate two examples of conventional supply feeders 3. The feeders shown in Figs. 2, 3 are straight troughs 18 formed on the rim of

a disk and extending over a significant radial distance, while the feeders shown in Fig. 4 are straight troughs 19 likewise formed on the rim of a disk but extending only over a limited radial distance.

In operation, articles supplied to the dispersing table 1 are dispersed over the supply feeders 3 by the operation of the electromagnetic vibrator 2. Since the supply feeders 3 are similarly vibrated by the electromagnetic vibrators 7, the articles supplied to the supply feeders 3 are supplied into pool hoppers 5 and thence into weighing hoppers 15 associated therewith. An electronic computer, (not shown,) of the apparatus (scales) then performs a combinatorial arithmetic operation based on weight values measured in the respective weighing units and selects a combination of the weighing hoppers that gives a total weight of articles equal or closest to a preset weight. The weighing hoppers corresponding to this combination are opened, so releasing the articles received therein into the collecting chute 14 to be further discharged therefrom onto a conveyor or into a packaging machine, not shown. Articles to be weighed are supplied to the dispersing table 1 by a supply conveyor, not shown, under control of a photoelectric sensor comprising the light projector 8 and the light receiver and, hence, in dependence upon whether a light signal is being transmitted from the light projector 8 to the light receiver 8' in such a manner that a fixed quantity of the

articles may be placed on the dispensing table 1 at all times.

A supply feeder system for an embodiment of the invention is shown in Figs. 5 and 6, wherein portions similar to those shown in Figs. 1 through 4 are designated by like reference characters. A plurality of straight supply feeders 18 in the shape of troughs are formed on the rim of the dispersing table 1 for extending radially of the dispersing table. A regulating plate or baffle plate 20 is mounted in each of the straight feeder troughs 18. The plate is movable, substantially about the center of the dispersing table 1 as the center of rotation, a predetermined distance between a solid-line position and a position indicated by phantom lines in Figs. 5, 6.

An operating mechanism for the regulating plate 20 is shown in Figs. 7 and 8. As shown in these figures, the regulating plate 20 is secured to a supporting plate 26 having a centrally located pin 29 which is fitted in an oblong hole 28 formed on the rim of a disk 23 affixed to some stationary portion of the machine frame. An operating disk 25 for operating the regulating plate 20 is secured at its center to the bottom end face of a shaft 24 fulcrumed at the center of the stationary disk 23, and a pin 27 having a vertical extension is secured to the outer rim of the operating disk 25, the vertical extension engaging with a mating opening in the supporting plate 26 on the side

opposite from the regulating plate 20. It should be noted that all of the regulating plates 20 are fitted to the stationary disk 23 and operating disk 25, although only one regulating plate 20 is illustrated for clarity.

Fig. 9 shows a modified embodiment of the operating mechanism shown in Figs. 7 and 8, comprising a quadric linkage formed by four rods 30 through 33 for displacing the regulating plate 20. The rod 30 of the linkage is secured to the disk 23 shown in Fig. 7 and the regulating plate 20 is secured to the rod 32 opposite to the rod 30. The regulating plate 20 may be displaced in the direction of the arrow by displacement of the linkage indicated likewise by the arrow in Fig. 9.

In the operation of the apparatus having the supply feeders 3 as mentioned above, the regulating plates 20 mounted in respective ones of the straight supply feeders 3 are displaced in the direction of the arrow marks in Figs. 7, 9 individually or all at once by manual operation. In this manner, the area of the flow path of each supply feeder 3 may be regulated as required for controlling the quantity of the articles to be supplied through the supply chute.

In the automatic operation of the regulatory plates 20, operating parameters of the combinatorial weighing process such as target weight or apparent specific gravity of the articles to be weighed are set.

A stepping motor is then driven according to a predetermined operation sequence for positioning the regulating plat s 20. In the foregoing, the regulating plates 20 are mounted in all of the straight supply feeders 18. However, in instances where varying quantities of articles are to be supplied to these feeders 18, it is not always necessary that the totality of the straight feeders 18 be equipped with the regulating plates 20.

In the operation of the regulating plates 20 shown in Fig. 8, the shaft 24 supported by the fixed disk 23 is turned through a predetermined angle for similarly rotating the regulating plate through a predetermined angle. The supporting plate 36 connected to the operating disk 25 by the projection 27 is swung in this manner about the projection 29 fitted in the oblong hole 28 formed in the fixed disk 23 for displacing the regulating plate 20.

In the case of the link chain shown in Fig. 9, the link chain is driven by means, not shown, for displacing the link chain and hence the regulating plate 20 as shown in Fig. 9. The link chain may be driven by any means designed to act on the rods 31, 33 of the link chain in a well-known manner.

In an embodiment of the present invention as illustrated and described hereinabove, the feeders for supplying the articles to the weighing machines are provided with regulating plates for controlling the quantities of the

articles to be supplied from the feeders, and the quantities of the articles supplied by the feeders may be controlled by the operation of these regulating plates, thus making it possible to adjust the quantities of the articles more finely than in the conventional methods resorting to adjustment of supply level, vibration time intervals or amplitudes of vibration and, above all, to make possible the weighing out of even smaller quantities of articles.

As many apparently widely different embodiments of the present invention can be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

CLAIMS.

1. A combinatorial weighing apparatus comprising a plurality of weighing machines (4), a dispersing table (1), and a plurality of supply troughs (18) extending from the dispersing table (1) to the respective weighing machines (4) for conveying thereto respective quantities of articles to be weighed, which articles are delivered to the supply troughs (18) by way of the dispersing table (1) when the apparatus is in use, characterised by respective flow-regulating plates (20) extending respectively within the said supply troughs and selectively movable therein to regulate the flow of such articles along the troughs when the apparatus is in use.

2. An apparatus as claimed in claim 1, in which said flow-regulating plates are approximately equal in length to the supply troughs and extend along the respective troughs, substantially radially from the dispersing table, whilst being movable substantially circumferentially of the dispersing table.

3. An apparatus as claimed in claim 1 or 2, in which each of said flow-regulating plates is movable across its supply trough, from a position abutting against one side wall of the supply trough, in such manner that the distance traversed by a downstream end of the plate is larger than that traversed by an upstream end thereof, nearer the dispersing table.

4. An apparatus as claimed in claim 1, 2 or 3, including an operating mechanism for said flow-regulating plates, which mechanism comprises an operating disc mounted on a rotary shaft supported at the centre of a stationary disc, and respective supporting members for the flow-regulating plates, each said supporting member being pivotally connected at a radially inner end thereof to an associated one of a plurality of locations around the rim of said operating disc, and being secured at a radially outer end thereof to an associated one of said flow-regulating plates,

said stationary disc having in a radially outer portion th reof radially extending elongate apertures adapted for guiding projections of the respective supporting members.

5. An apparatus as claimed in claim 1, 2 or 3, including an operating mechanism for each said regulating plate, which mechanism comprises a quadric linkage having four rods of which an inner rod, being the rod nearest to the dispersing table, is fixed in position, an outer rod is secured to the flow-regulating plate concerned and, said inner and outer rods are pivotally interconnected, at the respective ends thereof, by means of the remaining two rods, which two rods are of unequal lengths.

Fig. 1

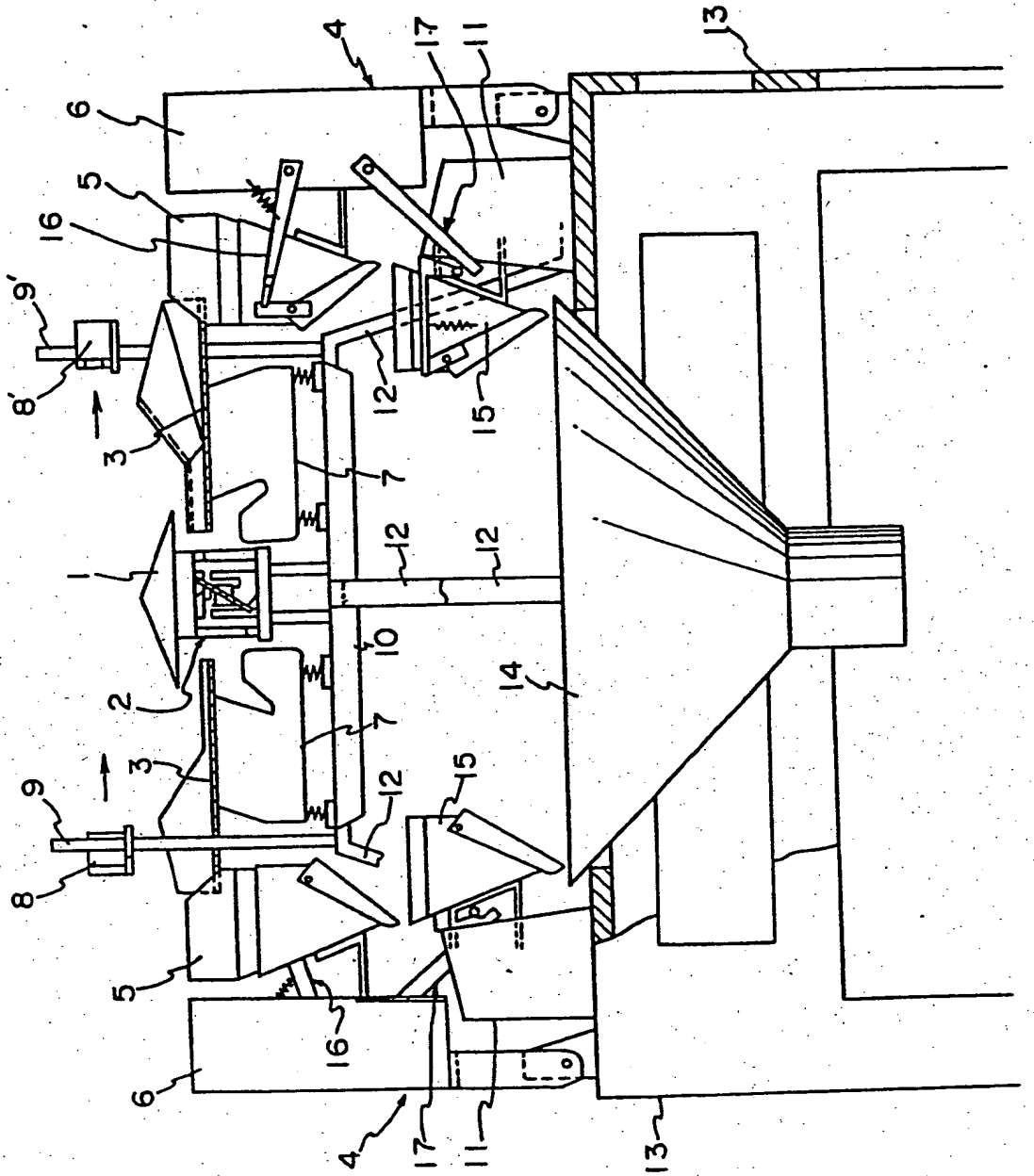

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Fig. 2

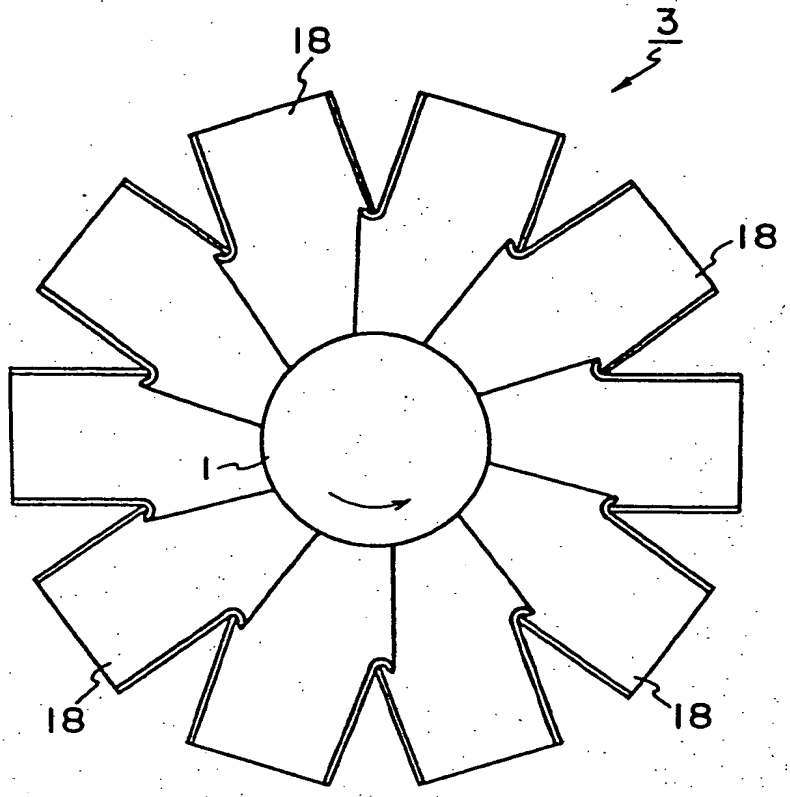


Fig. 3

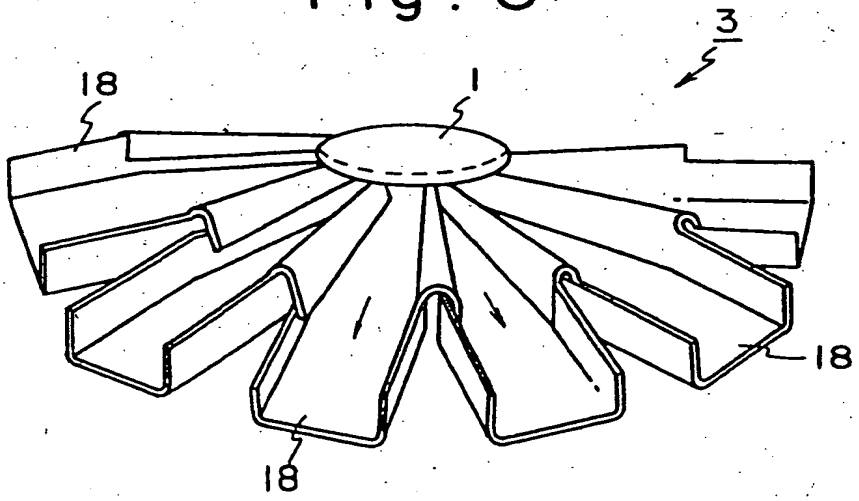


Fig. 4

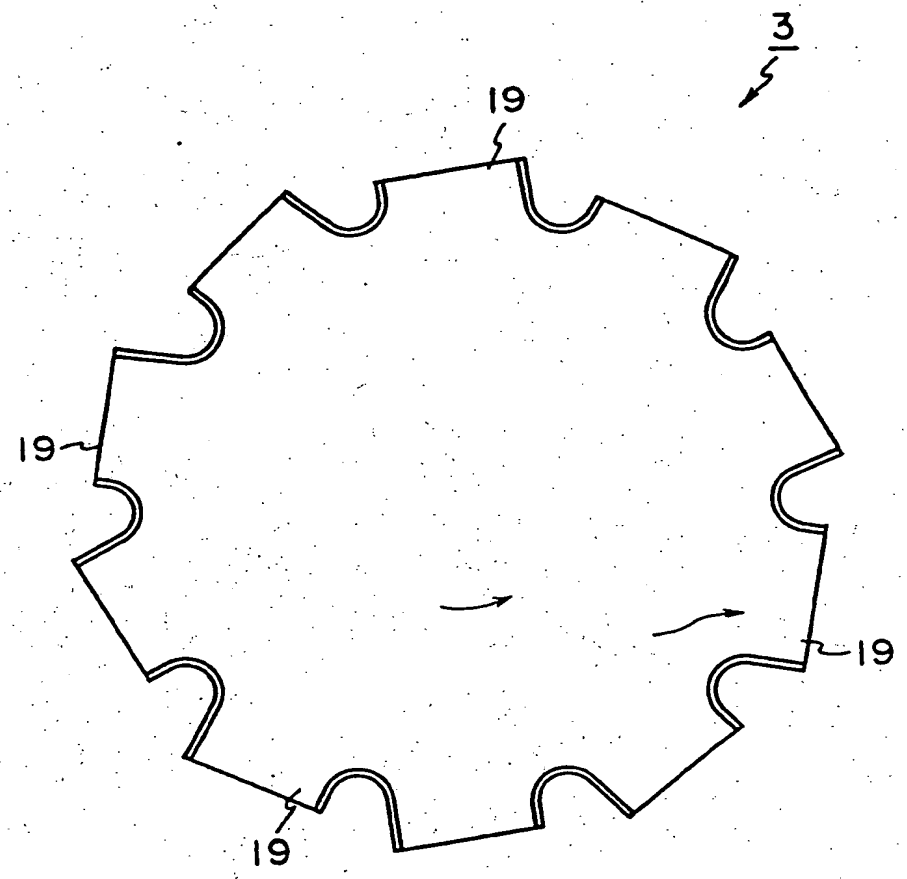


Fig. 5

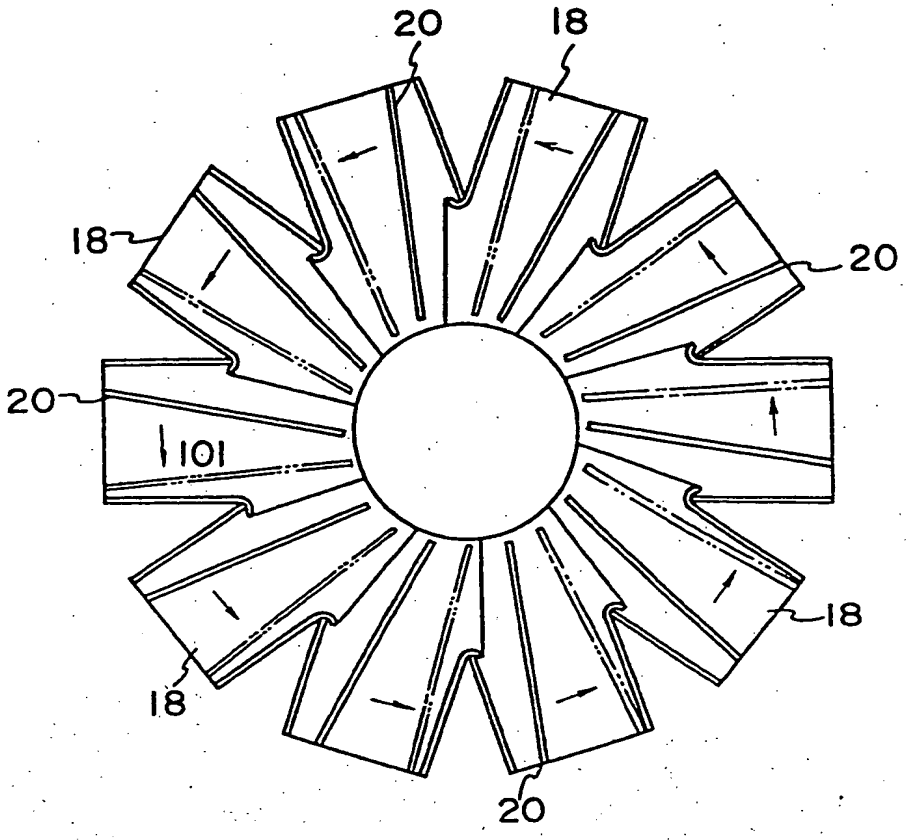
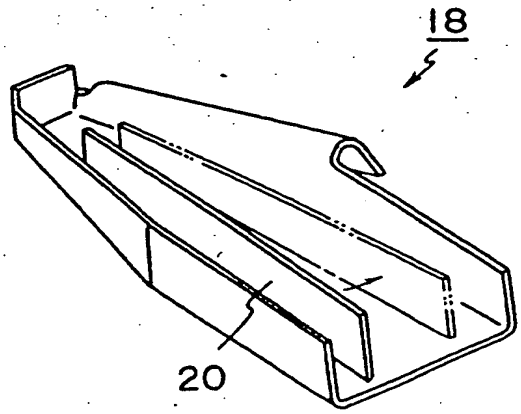


Fig. 6



5/5

Fig. 7

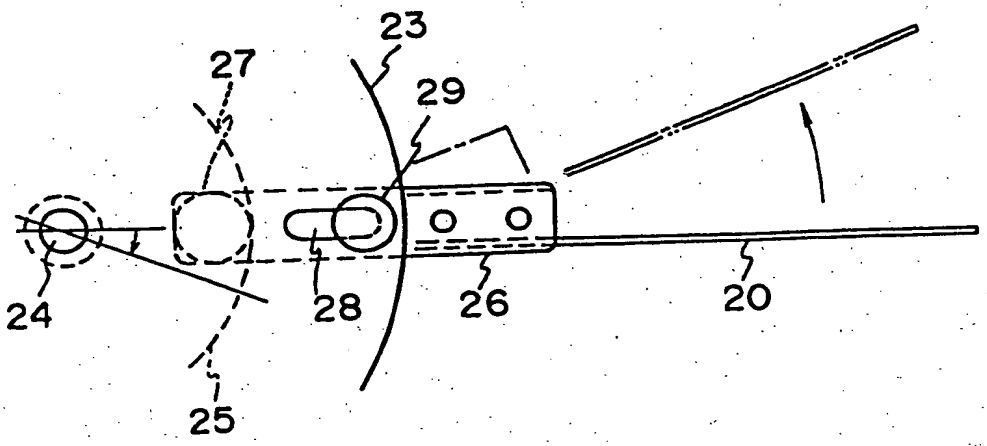


Fig. 8

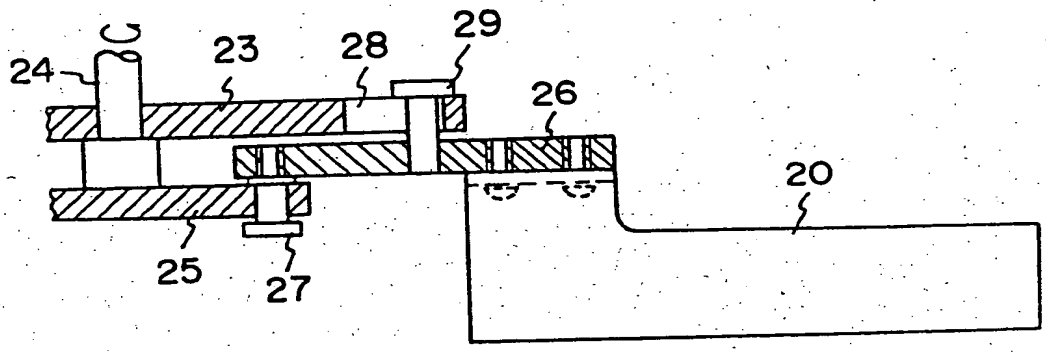


Fig. 9